PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Evaluate Interactions Of American Shad With Salmon In The Columbia River

BPA project number: 20095
Contract renewal date (mm/yyyy): ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
U.S. Geological Survey, Biological Resources Division

Business acronym (if appropriate) USGS-BRD

Proposal contact person or principal investigator:

Name	Dennis W. Rondorf
Mailing Address	5501A Cook-Underwood Rd.
City, ST Zip	Cook, WA 98605
Phone	509 538-2299
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Email address	dennis_rondorf@usgs.gov

NPPC Program Measure Number(s) which this project addresses
5.7 Reduce predation and competition, 5.7A.2 Explore the population ecology of shad..., 5.7B.9 Explore population ecology of shad... adverse interactions with salmonids.... 5.7B.11 ...reduce numbers of shad..., 6.1B.1 Evaluate effects of shad population..

FWS/NMFS Biological Opinion Number(s) which this project addresses
NMFS BiOp 13.h. The BPA shall investigate the effects of the intensified competition for food resulting from the introduction of non-native species and production of hatchery fish in the Columbia River Basin

Other planning document references
NMFS Recovery Plan 2.8.b.2 ...control fishes that prey on or compete with juvenile salmonids, 2.8.b.3 ...reduce American shad in the Columbia River

Wy Kan Ush Me Wa Kush Wit section 5, hypotheses 9: Large numbers of shad also impede salmon passage through adult fishways.

Columbia River Fish Management Plan, 1996 All-Species Review, Shad Management Issues: 1) competition between shad and juvenile salmonids for limited food and habitat resources. 2) noncompetitive, but stressful, interactions between shad and salmon, such as disease transmission or migration delay at dam fish passage facilities. 3) inaccurate counts of other concurrently migrating species. 4) contribution of shad to the forage base and ultimately the survival of predators of juvenile salmonids.

Short description
Analyze existing data to assess the potential interactions between the increasing abundance of American shad and declining numbers of salmon relative to competition, and the changing ecosystem of the Columbia River.

Target species
American shad, chinook salmon

Section 2. Sorting and evaluation

Subbasin

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☐ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☒ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☐ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Analyze existing data on the Columbia River American shad	a	Conduct literature review and compile existing data on American shad in the Columbia River basin
		b	Characterize adult American shad migration patterns using historical dam passage data
		c	Determine spatial and temporal occurrence of juvenile American shad and juvenile fall chinook salmon using existing data
		d	Determine the food habits of juvenile American shad and juvenile fall chinook salmon using existing data
2	Summarize potential methods to control the Columbia River American shad population	a	Summarize harvest methods
		b	Summarize potential control methods
		c	Evaluate effects of shad biomass on salmon passage
3	Provide current information base on Columbia River American shad to fisheries managers	a	Conduct workshop on Columbia River American shad
		b	Publish proceedings of workshop as synthesis of information on Columbia River American shad

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	10/1999	9/2000		Technical report	50.00%
2	10/1999	9/2000		Technical report	30.00%
3	10/1999	9/2000		Workshop proceedings	20.00%
				Total	100.00%

Schedule constraints
none

Completion date
9/2000

Section 5. Budget

FY99 project budget (BPA obligated): $0

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	USGS-BRD	%23	34,905
Fringe benefits		%6	8,627
Supplies, materials, non-expendable property		%0	600
Operations & maintenance		%0	
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%0	
NEPA costs		%0	
Construction-related support		%0	
PIT tags	# of tags:	%0	
Travel		%0	400
Indirect costs	overhead costs	%15	22,622
Subcontractor	USFWS	%22	33,554
Subcontractor	CRITFC	%24	36,606
Other	Sponser workshop and print proceedings	%10	15,000
TOTAL BPA FY2000 BUDGET REQUEST			$152,314

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
		%0	
		%0	
		%0	
		%0	
Total project cost (including BPA portion)			$152,314

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget				

Section 6. References

Watershed?	Reference
☐	Adams. S. M., and J. E. Breck. 1992. Bioenergetics In C. B. Shreck and P. B. Moyle (eds.), Methods for Fish Biology. American Fisheries Society, Bethesda, MD.
☐	Chapman, D.W., A. Giorgi, M. Hill, A. Maule, S. McCutcheon, D. Park, W. Platts, K. Pratt, J. Seeb, L. Seeb, and F. Utter. 1991. Status of Snake River chinook salmon. Prepared for PNUCC by Chapman Consultants, Inc., Boise, ID.
☐	Columbia River Fish Management Plan, All Species Review, 1996

☐	Crecco, V., and M. Blake. 1983. Feeding ecology of coexisting larvae of American shad and blueback herring in the Connecticut River. Transactions of the American Fisheries Society 112:498-507.
☐	Dirkin, J.T., S.J. Lipovsky, and R.J. McConnell. 1979 (Jan.). Biological impact of a lowline disposal project near Pillar Rock in the Columbia River Estuary. Final report of research submitted to the U.S. Army Corps of Engineers, Portland District.
☐	Kaczynaki, V.W. and J.F. Palmisano. 1993. Oregon's wild salmon and steelhead trout: A review of the impact of management and environmental factors responsible for the decline and lack of recovery of Oregon's wild anadromous salmonids, dated 04/93.
☐	McCabe, G.T., Jr., W.D. Muir, R.L. Emmett, and J.T. Durkin. 1983. Interrelationships between juvenile salmonids and nonsalmonid fish in the Columbia River estuary. Fishery Bulletin: 81:(4)815-826.
☐	Monk, B., D. Weaver, C. Thompson, and F. Ossiander. 1989. Effects of flow and weir design on the passage behavior of American shad and salmonids in an experimental fish ladder. North American Journal of Fisheries Management 9:60-67.
☐	Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.L. Prestegaard, B.D. Richter, R.E. Sparks, and J.C. Stromberg. 1997. The natural flow regime: a paradigm for river conservation and restoration. BioScience 47(11):769-784.
☐	Quinn, T., and D. Adams. 1996. Environmental changes affecting the migratory timing of American shad and sockeye salmon. Ecology 77:1151-1162.
☐	Rondorf, D., G. Gray, and R. Fairley. 1990. Feeding ecology of subyearling chinook salmon in riverine and reservoir habitats of the Columbia River. Transactions of the American Fisheries Society 119:16-24.
☐	Scott, W.B., and E.J. Crossman. 1973. Freshwater fishes of Canada. Bull. Fish. Res. Board Can. 184. 966 pp.
☐	Stanford, J.A. , J.V. Ward, W.J. Liss, C.A. Frissell, R.N. Williams, J.A. Lichatowich and C.C. Coutant. 1996. A general protocol for restoration of regulated rivers. Regulated Rivers: Research and Management 12:391-413.
☐	Williams, R.N. and eleven coauthors. 1996. Return to the river: restoration of salmonid fishes in the Columbia River ecosystem. Portland (OR): Northwest Power Planning Council.
☐	
☐	
☐	

PART II - NARRATIVE

Section 7. Abstract

The increasing abundance of American shad in the Columbia River Basin has prompted concerns about their potential impacts on dwindling salmon populations. Managers do not know if recent large increases in American shad contribute to declines in fall chinook salmon, or are a response to a changing ecosystem. This study addresses the lack of information on American shad recognized in the NPPC's Fish and Wildlife Program, the NMFS's Biological Opinion and Proposed Recovery Plan, and the Columbia River Fish Management Plan. Our objectives are to analyze existing data on the Columbia River American shad, summarize potential methods to control the Columbia River American shad, and provide the current information base on Columbia River American shad to fisheries managers.

Section 8. Project description

a. Technical and/or scientific background

To date, minimal published information exists on the ecology and population dynamics of American shad in the Columbia River basin. American shad were introduced to the Columbia River in 1871 (Scott and Crossman 1973) and have increased dramatically in recent decades. Prior to 1960, the annual run of adult shad above Bonneville Dam was usually less than 20,000 (Chapman et al. 1991). Since 1960, numbers of returning adult American shad passing The Dalles Dam on the Columbia River have increased from 81,000 shad in 1960 to over 4 million in 1990 (2.7 million shad in 1997). Conversely, adult chinook salmon numbers have steadily declined from almost 500,000 in 1960 to approximately 110,000 in 1995 (Williams et al. 1996). During that time, The Dalles Dam was completed in 1957 and John Day Dam in 1968, with the Lower Snake River dams being completed in the 1960s and 70s, further modifying the ecosystem.

The increase of American shad and decline of fall chinook salmon may be directly related to changes in habitat or partially to interactions between the two species. The increase in abundance of American shad and decline of fall chinook salmon may reflect the changes in habitat and passage resulting from impoundments and dams built on the Columbia River during the 1950's and 1960's. Both American shad and fall chinook salmon are native to large rivers and juveniles of both rear in mainstem riverine habitats. Several recent reviews of regulated rivers concluded that non-native species, in this case American shad, often increase in abundance as flow regimes become more regulated in rivers and native species, such as fall chinook salmon in the Columbia River, often decline in abundance (Stanford et al. 1996, Poff et al. 1997). Alternatively, the impoundments of the Columbia River may provide the planktivorous juvenile American shad a competitive advantage over juvenile fall chinook salmon when the juveniles of both species co-exist in reservoirs.

The high abundance of juvenile shad and possible diet overlap with juvenile fall chinook salmon indicate a potential competitive interaction. Adult American shad ascend the Columbia River to spawn from May through July, with most spawning above Bonneville Dam occurring between John Day Dam and the confluence of the Snake and Columbia rivers (Quinn and Adams 1996). In that reach, the presence of high numbers of larval and juvenile American shad coincides with the early August median passage dates at McNary Dam of emigrating wild, juvenile fall chinook salmon from the Snake River based on PIT tag detections. Furthermore, this spatial and temporal overlap is not limited to the reservoirs. It is estimated that at least 600 million juvenile shad enter the Columbia River estuary annually to feed and grow. This rearing also overlaps with the rearing of juvenile fall chinook salmon in the estuary (Chapman et al. 1991).

It is well established that planktivorous fishes, such as American shad, can alter the abundance and size structure of zooplankton resources. Larval and juvenile American shad are effective planktivores that feed predominantly on crustacean zooplankton (Crecco and Blake 1983). Preliminary studies suggest that juvenile American shad in the Columbia River estuary feed on amphipods, calanoid copepods, cladocerans and insects (Dirkin et al. 1979). Rondorf et al. (1990) found that zooplankton (mostly *Daphnia* spp.) were a primary component of subyearling chinook salmon diets in reservoir habitats. If rearing American shad greatly reduce or alter zooplankton abundance and community structure, then reservoir food webs may be inadequate to support emigrating juvenile fall chinook salmon. Furthermore, there may be significant overlap with the diet of fall chinook salmon through fall and winter in the estuary (McCabe et al. 1983).

As juvenile salmon numbers decline, shad may extend the prey base for piscivorous fishes during the late fall and winter, thus serving to maintain predator populations at high levels (Kaczynaki and Palmisano 1993). For example, large populations of juvenile American shad could provide an abundant prey source, and thus lead to increases in condition, overwinter survival, and reproductive fitness of salmonid predators (e.g., northern pike minnow). Conversely, larval and juvenile American shad may reduce predation on juvenile salmonids by providing an alternate prey source for predators. Early life stages of American shad could also directly benefit juvenile salmonids by providing an abundant, nutritive food resource to salmonids in reservoir habitats.

The high numbers of returning adult American shad in fish ladders may cause avoidance or delay in the return of adult salmon. The adult shad migration peaks from mid June to late July, and coincides with adult return migrations of sockeye and summer chinook salmon. One solution to adult passage problems has been to modify passage configuration so that adult shad can readily pass and not accumulate

in the ladders. Ironically, such passage improvements have extended the range of American shad to Priest Rapids Dam on the Columbia River, and above Lower Granite Dam on the Snake River (Monk et al. 1989). We speculate that the consequences of opening access to such large reaches of spawning and rearing habitat suitable to American shad may not be fully realized at this time. Harvest offers one alternative to reduce the number of adult American shad, but it has been generally under utilized. For example, between 1977-97 the commercial harvest rates have ranged as high as 8%, but was only 1% in 1997.

b. Rationale and significance to Regional Programs

Objective 1: Analyze existing data on the Columbia River American shad

This objective relates directly to the NPPC's FWP measure 5.7B.9 "Explore population ecology of shad to determine the extent of adverse interactions with salmonids". Other specific plan measures that this objective relates to are: NPPC's FWP 5.7 "Reduce predation and competition"; NMFS BiOp 13.h. "The BPA shall investigate the effects of the intensified competition for food resulting from the introduction of non-native species and production of hatchery fish in the Columbia River Basin"; NMFS Recovery Plan 2.8.b.2 "Control fishes that prey on or compete with juvenile salmonids"; Columbia River Fish Management Plan, 1996 All-Species Review, Shad Management Issues: 1) competition between shad and juvenile salmonids for limited food and habitat resources; 2) noncompetitive, but stressful, interactions between shad and salmon, such as disease transmission or migration delay at dam fish passage facilities; 3) inaccurate counts of other concurrently migrating species; and 4) contribution of shad to the forage base and ultimately the survival of predators of juvenile salmonids.

Objective 2: Summarize potential methods to control the Columbia River American shad population

This objective relates directly to the NPPC's FWP measures 5.7A.2 "Eliminate shad from the Columbia River system above Bonneville and reduce the shad population below Bonneville Dam", 5.7B.9 "Identify effective methods for control", 5.7B.11 "Managers should use whatever methods are available to reduce the numbers of shad that spawn below Bonneville", 6.1B.1 "Evaluate the effects of shad population increases on adult salmon passage at mainstem dams"; NMFS Recovery Plan 2.8.b.2 "Control fishes that prey on or compete with juvenile salmonids", 2.8.b.3 "Reduce American shad in the Columbia River"; Columbia River Fish Management Plan, 1996 All-Species Review, Shad Management Issues: 2) noncompetitive, but stressful, interactions between shad and salmon, such as disease transmission or migration delay at dam fish passage facilities. 3) inaccurate counts of other concurrently migrating species; and Wy Kan Ush Me Wa Kush Wit section 5, hypotheses 9: Large numbers of shad also impede salmon passage through adult fishways.

Objective 3: Provide current information base on Columbia River American shad to fisheries managers

This objective will serve to gather and summarize existing information on American shad in the Columbia River basin. This information will then be available to fisheries managers to help direct future research on the American shad to determine its role in the Columbia River ecosystem.

c. Relationships to other projects

This project has a direct relationship to project 9007800, "Large-Scale Patterns of Predation on Juvenile Salmonids", in that both of these projects are seeking to investigate either direct or indirect interactions of American shad with juvenile salmonids in the Columbia River. Objective 2 of project 9007800 will look at the effects that an alternate food source (juvenile American shad) may have on the success of juvenile salmonid predators during the fall and winter months. The investigation of potential direct and indirect interactions between American shad and salmon, as proposed here and in project 9007800, will serve to broaden the current information base on American shad, and their potential impact on salmon populations in the Columbia River basin.

d. Project history (for ongoing projects)

none

e. Proposal objectives

Objective 1: Analyze existing data on the Columbia River American shad

Ho: Juvenile American shad and juvenile fall chinook salmon occur uniformly over space and time.
Ho: Diets of juvenile American shad and juvenile fall chinook salmon do not overlap.
Product: This objective will provide a description of the adult American shad migration, as well as the distribution patterns and food habits of juvenile American shad and juvenile fall chinook salmon in John Day Reservoir. This information will be included in a final technical report.

Objective 2: Summarize potential methods to control the Columbia River American shad population

Ho: The presence of American shad in fishways does not disrupt adult salmonid passage.
Product: This objective will provide an overview of the harvest methods and potential control methods that have been used or may be used in the future on American shad in The Columbia River. This information will be included in a final technical report.

Objective 3: Provide current information base on Columbia River American shad to fisheries managers

Product: This objective will provide a complete overview of the existing knowledge base on American shad in the Columbia River basin. This information will be published as proceedings from a workshop on American shad in the Columbia River basin.

f. Methods

Task 1.a: Conduct literature review and compile existing data on American shad in the Columbia River basin

Methods: An exhaustive literature review will be completed. Existing data from the Corps of Engineers, Fish Passage Center, National Marine Fisheries Service, Biological Resources Division of the USGS, and other state, federal, and tribal agencies will be complied and reviewed. After review of existing data,

pertinent analysis will be conducted. Product will be provided to Project 8810804 PSMFC. We expect to be fully successful at this task.

Task 1.b: Characterize adult American shad migration patterns using historical dam passage data

Methods: Temporal and longitudinal progression of the adult up-river migration will be characterized using historical dam passage counts. We expect to be fully successful at this task.

Task 1.c: Determine the spatial and temporal occurrence of juvenile American shad and juvenile fall chinook salmon using existing data

Methods: We propose to analyze existing hydroacoustic data collected during project 9102900 to assess the spatial and temporal occurrence of juvenile American shad and juvenile fall chinook salmon in John Day Reservoir. From 1991 to 1996 hydroacoustic techniques were used to assess the spatial and temporal distribution of outmigrant juvenile fall chinook salmon in McNary and John Day Reservoirs. During the latter part of the juvenile fall chinook outmigration (August/September) in John Day Reservoir, many juvenile American shad were also present in the reservoir. Over the course of this study, fish distribution and abundance estimates were determined along transects at selected index sites with a mobile hydroacoustic system deployed from a boat. Water velocities were also measured along selected transects using an acoustic Doppler current profiler (ADCP) to assess water velocity availability/usage estimates for juvenile fall chinook salmon. Vertical distribution, horizontal distribution, mean water velocity and fish density were measured in 0.5 m depth strata along 10 m segments. All hydroacoustic data were geo-referenced using a Global Positioning System (GPS). We propose to analyze this late season hydroacoustic data on juvenile American shad to determine their spatial and temporal occurrence relative to juvenile fall chinook salmon in John day Reservoir. Mean fish density in selected depth strata and segments will be compared using an analyses of variance (ANOVA) to determine if fish density differs significantly between depth strata, segment and/or index study site. Regression analyses will be used to identify environmental variables (e.g., temperature, turbidity, light level) that may be determinates of fish density at index sites for each species.

Supplemental fish distribution data were collected using mid-water trawling techniques. Trawling techniques were also used to gather data on species composition estimates at the index sites, as current hydroacoustic techniques are unable to differentiate between fish species of similar size. Juvenile American shad were caught incidentally while trawling later in the year (August/September) in John Day Reservoir and were also preserved. We propose to examine these preserved juvenile American shad to determine their food habits (task 1.d). We expect to be fully successful at this task.

Task 1.d: Determine the food habits of juvenile American shad and juvenile fall chinook salmon using existing data

Methods: The stomach contents of juvenile shad and juvenile fall chinook salmon collected during project 9102900 from John Day Reservoir will be analyzed to assess prey preference, diet overlap, and total food consumption (Adams and Breck 1992). Analyses and diet comparisons between juvenile American shad and juvenile fall chinook salmon will be made to determine if potential competitive interactions may exist between the two species during their co-occurrence in John Day Reservoir. We expect to be fully successful at this task.

Task 2.a: Summarize harvest methods

Methods: We will review existing harvest methods previously used by tribal and commercial fishers to harvest American shad on both the east and west coasts. This task will provide a summary of the information gathered while conducting a thorough literature review (task 1.a). We will also look at harvest technologies that have not been previously tested in the Columbia River American shad fishery. Emphasis will be placed on identifying harvest technologies that eliminate or minimize negative impacts to juvenile and adult salmonids present during the harvest season.

Task 2.b: Summarize potential control methods

Methods: We will examine alternative methods of control including an evaluation of fish ladder design and habitat modification to determine if adult American shad passage at Columbia River dams can be diverted without inhibiting adult salmonid passage. This task will be a synthesis of information from the literature (task 1.a), and observations made during other tasks of this project. The migration habits of adult American shad to be characterized in task 1.b may provide insight in controlling the Columbia River American shad population.

Task 2.c: Evaluate effects of shad biomass on salmon passage

Methods: Evaluate fish passage facilities (upstream and downstream) at dams to determine if passageways similar to submerged orifices removed from Ice Harbor dam in approximately 1984/5, could be "retooled" to control American shad upstream migrations at selected sites and still allow for optimum anadromous salmonid use. We will also evaluate potential methods to prevent American shad from "locking-through" the dams with vessel traffic.

Task 3.a: Conduct workshop on Columbia River American shad

Methods: A workshop on American shad in the Columbia River will be sponsored by the USGS-BRD, the USFWS, and the CRITFC. The intent of the workshop will be to bring together federal, state, and tribal fisheries researchers and managers to share existing published and unpublished information on the American shad in the Columbia River basin.

Task 3.b: Publish proceedings of workshop as synthesis of information on Columbia River American shad

Methods: The proceedings from the above workshop will be published as synthesis of information on the Columbia River American shad and distributed to interested individuals.

g. Facilities and equipment

Office, laboratory space, shop, and storage space are furnished at the Columbia River Research Laboratory of the Biological Resources Division, U.S. Geological Survey. A computer network and analytical software are available to project staff. USGS-BRD, CRITFC and USFWS will provide workshop facilities and arrange printing of the workshop proceedings.

h. Budget

The budget for this project is comprised almost entirely of salary to cover personnel for the analyses and synthesis of existing available data on American shad in the Columbia River. Approximately 10% of the budget will be used to sponsor a workshop and for publishing the proceedings of the workshop. Indirect costs reflect overhead charges pre-determined by the agency(s) conducting the tasks (USGS, USFWS, CRITFC).

Section 9. Key personnel

Dr. Thomas W. H. Backman, Senior Fishery Scientist

EDUCATION:
B.Sc. and M.Sc. in Marine Biology, San Diego State University.
Ph.D. in Fisheries, University of Washington.

CURRENT EMPLOYMENT:
Columbia River Inter-Tribal Fish Commission 729 N. E. Oregon, Suite 200
Portland, OR. 97232

Dr. Backman has been a Senior Fishery Scientist with the Commission since 1991. During that time he as served as the President of the Oregon Chapter of the American Fisheries Society, and was a member of the CBFWA shad advisory group. Dr. Backman provides scientific expertise on salmon recovery issues by conducting research, developing scientific papers and analyses, participation in workshops, formulating recovery strategies, and providing expert testimony.

Prior to CRITFC, Dr. Backman was a Fishery Biologist (GS-13) with the US Fish and Wildlife Service (FWS). His duties with FWS were: Administrated and participated in technical groups for the U.S. Fish and Wildlife Service under the Emergency Stripped Bass Act. Administrated the Andramous Grants Program. Dr. Backman was Principle Investigator and Project Leader for an American shad research program at the National Research Laboratory in Wellsboro PA. Dr. Backman's graduate research (NSF funded) focused on fish habitat related research, and included developing genetic concepts and restoration technology for depleted and damaged submerged aquatic vegetation and habitat.

T. W. H. Backman. 1989. Entrainment Net Effect Means for Transporting Juvenile American Shad. U.S. Fish and Wildlife Service, Research Information Bulletin 89-93.

T. W. H. Backman. 1992. Larval American Shad: Effects of Age and Group Size on Swimming and Feeding Behavior. Transactions of the American Fisheries Society 121(4):508-516.

T. W. H. Backman, and R. M. Bennett. 1993. Evaluation of Habitat
Suitability Index Models for Riverine Life Stages of American Shad, with Proposed Models for Premigratory Juveniles. U.S. Fish and Wildlife Service Biological Report 14.

R. M. Bennett, and T. W. H. Backman. 1993. Habitat Use by Spawning Adult,
Egg, and Larval American Shad in the Deleware River. Rivers:4(3):227-238.

Travis C. Coley, Fishery Biologist

EDUCATION:
B.S. Mississippi State University, Fisheries Management, 1976.
M.S. University of Idaho, Fisheries Resources, 1979.

CURRENT EMPLOYMENT:
U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office
9317 N. E. Highway 99, Suite I

Vancouver, WA 98665

Travis is the team leader for the Habitat and Natural Production Team at the Columbia River Fisheries Program Office, U.S. Fish and Wildlife Service. Supervises a staff of 12 biologists and technicians working primarily on habitat assessment, habitat restoration, and fish population assessment and monitoring. Travis has served in this capacity since 1991. Prior to the current position he served as Assistant Project Leader of the Idaho Fisheries Resources Office, U. S. Fish and Wildlife Service, Ahsahka, Idaho.

Travis worked for the National Marine Fisheries Service from 1978 to 1986. The majority of duties were Columbia River estuary fish ecology and salmonid smoltification research.

Durkin, J.T., T.C. Coley, K.J. Verner, and R.L. Emmett. 1981. An evaluation of aquatic life found at four hydraulic scour sites in the Columbia River estuary elected for potential sediment disposition. Proceedings of the National Symposium of Freshwater Inflow to Estuaries, USFWS, San Antonio, Texas. Vol. I: 436-452.

McCabe, G.T., Jr., T.C. Coley, R.L. Emmett, and J.T. Durkin. 1981. The effects of Mt. St. Helens on the fishes in the Columbia River estuary (abstract). Estuaries 4(3):247

Giorgi, A.E., G.A. Swan, W.S. Zaugg, T.C. Coley, and T.Y. Barila. 1988. Susceptibility of chinook salmon smolts to bypass systems at hydroelectric dams. North American Journal of Fisheries Management 8:25-29.

Muir, W.D., A.E. Giorgi, and T.C. Coley. 1994. Behavioral and physiological changes in yearling chinook salmon during hatchery residence and downstream migration. Aquaculture 127(69-82).

Muir, W.D. and T.C. Coley. 1996. Diet of yearling chinook salmon and feeding success during downstream migration in the Snake and Columbia Rivers. Northwest Science 70(298-305).

Dennis W. Rondorf, Fishery Research Biologist

EDUCATION:
M.S. Oceanography and Limnology, University of Wisconsin, Madison, 1981
B.S. Wildlife Management, University of Minnesota, St. Paul, 1972

CURRENT EMPLOYMENT AND RESPONSIBILITIES:
D.W. Rondorf serves as a Fishery Research Biologist and Section Leader for the Anadromous Fish Ecology section at the Columbia River Research Laboratory, Biological Resources Division, U.S. Geological Survey, Cook, Washington. Current areas of research include the behavior and ecology of Snake River wild and hatchery fall chinook salmon, the distribution of smolts in relation to gas supersaturation in the main stem Columbia River, and behavior of smolts to evaluate a prototype surface collector at Lower Granite Dam, Washington. In recent years, D.W. Rondorf has led research teams using radio telemetry, geographic information systems (GIS), global positioning systems (GPS), remotely operated underwater vehicles (ROV), hydroacoustic fish stock assessment systems, and acoustic Doppler current profilers (ADCP) as research tools. Between 1979 and 1997, D.W. Rondorf was employed by the research division of the U.S. Fish and Wildlife Service and the National Biological Service to conduct research on juvenile salmon in the Columbia River basin.

Adams, N.S., D.W. Rondorf, S.D. Evans, J.E. Kelley, and R.W. Perry. 1998. Effects of surgically and gastrically implanted radio transmitters on swimming performance and predator avoidance of juvenile chinook salmon. Canadian Journal of Fisheries and Aquatic Sciences.

Adams, N.S., D.W. Rondorf, S.D. Evans, and J. E. Kelley. 1998. Effects of surgically and gastrically implanted radio transmitters on growth and feeding behavior of juvenile chinook salmon. Transactions of the American Fisheries Society 127:128-136.

Adams, N.S., D.W. Rondorf, E.E. Kofoot, M.J. Banach, and M.A. Tuell. 1998. Migrational characteristics of juvenile chinook salmon and steelhead in the forebay of Lower Granite Dam relative to the 1997 surface bypass collector tests. U. S. Army Corps of Engineers, Walla Walla, Washington.

Parsley, M.J., D.W. Rondorf, and M.E. Hanks. 1998. Remote sensing of fish and their habitats. Proceedings of instream and environmental flows symposium-technology and policy issues. (*In Press*) North American Lake Management Society and others, Denver, Colorado.

Rondorf, D.W., K.F. Tiffan, W.P. Conner, and H.L. Burge, editors. 1998. Identification of the spawning, rearing, and migratory requirements of fall chinook salmon in the Columbia River basin. Annual Report to the Bonneville Power Administration, Portland, Oregon.

Section 10. Information/technology transfer

This project will serve to synthesize and transfer or make available information assimilated from a literature review, the analyses of existing data, and a workshop on the American shad in the Columbia River basin. A technical report and proceedings from a workshop will be available to all interested parties and will specifically focus on providing information to fisheries managers about the American shad and it's potential impact on salmon in the Columbia River basin.

Congratulations!